601.05. METHOD OF MEASUREMENT.

Type I and Type I-A. Measure plain Riprap or plain Riprap and filter blanket separately by the ton (metric ton).

Type II and Type II-A. Measure special plain Riprap or special plain Riprap and filter blanket separately by the ton (metric ton).

Type III. Measure laid up Riprap by the square yard (square meter). This measurement covers the whole face area, regardless of thickness, and including additional thickness at base of walls.

Type IV. Measure grouted Riprap by the square yard (square meter). This measurement covers the whole face area, regardless of thickness, including additional thickness at the base of walls. Scales for weighing shall meet the requirement of Subsection 109.01.

Filter Fabric. Measure filter fabric complete in place by the square yard (square meter) of area covered. Laps will not be measured for payment.

601.06. BASIS OF PAYMENT.

Accepted Riprap, measured as provided above, will be paid for at the contract unit price as follows:

(A)	TYPE I	PLAIN RIPRAP	TON (METRIC TON)
(A-1)	TYPE I-A	PLAIN RIPRAP	.TON (METRIC TON)
(A-2)	TYPE I-A	FILTER BLANKET	TON (METRIC TON)
(B)	TYPE II	SPECIAL PLAIN RIPRAP	TON (METRIC TON)
(B-1)	TYPE II-A	SPECIAL PLAIN RIPRAP	TON (METRIC TON)
(B-2)	TYPE II-A	FILTER BLANKET CUBIC	TON (METRIC TON)
(C)	TYPE III	LAID UP RIPRAP	SQUARE YARD (SQUARE METER)
(D)	TYPE IV	GROUTED RIPRAP	SQUARE YARD (SQUARE METER)
(E)		FILTER FABRIC (RIPRAP)	SQUARE YARD (SQUARE METER)

Such payment shall be full compensation for furnishing all materials, equipment, labor, and incidentals to complete the work as specified.

SECTION 602
GABIONS AND REVEMENT MATTRESSES

602.01. DESCRIPTION.

This work shall consist of furnishing and placing both stone-filled wire-mesh baskets and plastic filter fabric in close conformity with the line, grades, dimensions, and details shown on the plans or established by the Engineer. Gabions and revetment mattresses are used to retain embankments and control erosion.

Gabions are wire-mesh baskets—box or rectangular shaped—filled in-place with hard, durable stone. Gabions have a minimum thickness of 1 foot (0.3 m).

Revetment Mattresses are similar to gabions except they have a maximum thickness of 1 foot (0.3 m) and are always rectangular baskets.

602.02. MATERIALS.

(a) **Material Requirements.** Provide materials as specified under the following subsections:

Filter Sand	703.04
Filter Fabric	712.02
Stone	713.04(a)2
Wire Baskets	732.09
Cubical stone for gabions and Revetment mattresses	713.02

(b) **Basket Requirements.** For twisted-wire mesh, supply gabion baskets maximum nominal mesh openings of 3x4 inches (75x100mm) and revetment mattresses and maximum nominal mesh openings of 2 1/2x3 inch (63x75mm) (unless otherwise specified on the plans).

For welded-wire mesh, supply gabion baskets maximum nominal mesh openings of 1 1/2x3 inches (38x75mm) and revetment mattresses and maximum nominal mesh openings of 1 1/2x3 inches (38x75mm).

NOTE: Unless otherwise specified on the plans, provide twisted-wire mesh baskets.

For each individual basket, use the same mesh style for the base, front, ends, back, diaphragms, and lid. Assemble successive baskets so that the strength and flexibility are in accordance with requirements of Subsection 732.09 to a single panel. Fabricate baskets to the dimensions shown on the plans, keeping the height, width, and length of each basket to within 5 percent of the specified dimensions. Install diaphragms that equally divide each gabion basket or revetment mattress into cells, the length of which does not exceed 1.5 times the base width of the gabion basket or 1.0 times the horizontal width of the revetment mattress, respectively. Fabricate diaphragms from the same type of mesh used for the basket body. Secure diaphragms in proper position on the base.

602.04. CONSTRUCTION METHODS.

(a) **Technical Supervision.** At the start of construction, provide on-site a technical representative from the basket manufacturer who is knowledgeable and experienced in construction of gabions and revetment mattresses. Make the representative available for consultation as needed during construction of the gabions or revetment mattresses.

(b) **Foundation Preparation.** Place baskets on a smooth excavation extending to the limits on the plans or as directed by the Engineer. Remove all loose or otherwise unsuitable materials. Fill all depressions to grade with suitable materials from adjacent required excavation, or other approved sources, and compact to a density at least equal to that of the adjacent foundation. Allow the Engineer to inspect the prepared surface before proceeding with subsequent construction.

(c) **Filter Sand Placement.** When required on the plans, uniformly spread filter sand on the prepared foundation surface as specified, making certain not to cause segregation of the filter sand. Repair any damage to the foundation surface during filter placement. Compact and finish filter sand as needed to make the surface even and free of mounds or windrows.

(d) **Filter Fabric Placement.** Place filter fabric as shown on the plans. Loosely lay the fabric so that it is free of tension, but has no folds, wrinkles or creases. Do not stretch the fabric.

Overlap adjacent strips by a minimum of 2 feet (0.6 m). Stagger vertical fabric laps at least 5 feet (1.5 m). Use full rolls whenever possible to reduce the number of vertical laps. Place the uphill or upstream layer of a lap on top.

Secure the fabric at the top to prevent displacement from its intended position. If securing pins are used to hold the fabric, place the pins in the lapped longitudinal joints, spaced on 10 feet (3 m) centers. Place securing pins through both fabric strips near the overlap midpoint.

Any defects, rips, holes, flaws or damage to the material will be cause for rejection. Torn or punctured fabric may be repaired by placing a layer of fabric over the damaged area, which overlaps a minimum of 2 feet (0.6 m) beyond the damaged area in all directions.

Cover filter fabric within 3 days of installation. Protect the fabric during shipment and storage from direct sunlight, temperature of 140°F (60° C) or more, dirt, dust, and debris. Keep fabric wrapped in a heavy duty protective covering until use.

(e) **Connections.** Use any of the following methods for connecting individual gabions or revetment mattresses, or groups of gabions or revetment mattresses. When Polyvinyl Chloride (PVC) coating is specified, use either PVC-coated connections or stainless steel connections.

(1) ***3/32 inch (2.2 mm) Tie Wire*.** When 3/32 inch (2.2 mm) tie wire is used as the joint material, assemble all vertical edges of each gabion panel first to form groups of empty gabions.

1.1 For twisted-wire mesh, construct the joint using single loop-double loop lacing pattern (locked loops) of 3/32 inch (2.2 mm) tie wire at 6 inch (150 mm) nominal spacing. Do not use simple spiraling (looping without locking) of tie wire.

1.2 For welded-wire mesh, construct the joint using alternating single and double half hitches (locked loops) in every mesh opening along the joint. Securely fasten all lacing wire terminals.

(2) Spiral Binders. When spiral binders are used with 7/32 inch (2.7 mm) wire or larger, rotate the spiral into position so that it passes through each mesh opening along the joint. Wrap both ends of all spiral binders at least two times around the mesh, to secure the spiral in place. Separate spiral binders 3 inch (75 mm) between continuous, successive loops.

NOTE: Do not use spiral binders after the stone has been placed in the baskets.

(3) Interlocking Rings (tiger tites). For gabions, use one interlocking ring in each mesh opening. For Revetment Mattress, use one interlocking ring in every mesh opening. Securely lock all rings.

(4) Overlapping Rings (spenax fasteners). Use overlapping rings only if a 1 inch (25 mm) lap can be consistently obtained. Install one ring in each mesh opening. Verify the gun used to close the overlapping rings is functioning properly and has the minimum required air pressure.

(5) Alternate Fasteners. Provide alternate fasteners having a minimum strength of 1400 pounds/ foot (20 kN/m) for galvanized gabions, 1250 pound/foot (18 kN/M) for PVC Gabions, and 800 pound/foot (12 kN/m) for revetment mattresses. Space connections to prevent separation between baskets from exceeding 2 inch (50 mm) during a connection tensile strength test. Use fasteners that do not damage the protective coating on the wire.

(f) **Assembly and Installation.**

(1) General. Assemble and place the empty baskets on the prepared surface. Place the front row of baskets first and successively construct toward the top of the slope. Check that all creases are in the correct position and the top of each side is level. Install the baskets so that when finished no gaps exist between adjoining basket units. Connect adjoining baskets in the same row before filling a basket with stone. Do not move baskets after filling with stone. Connect the next row of baskets to the previous row along all contacting edges.

(2) Connections. Make all connections by joining through selvage wire to selvage wire, selvage wire to edge wire, or selvage wire to mesh. If the connections cannot be made by one of the previous methods, mesh to mesh connections may be made.

For closing stone-filled basket lids, do not use alternate fasteners such as spirals, interlocking rings, or overlapping rings, unless otherwise approved. To gain approval, demonstrate that the fasteners can be properly installed on a stone-filled basket without excessively stretching the basket or damaging its protective coating.

(3) Stone-filling.

3.1 Fill baskets with stone by hand or machine with hand work to assure a minimum of voids between the stones. Do not damage wire coating. Maintain alignment throughout the filling process. Correct any excessive deformation and bulging of the mesh before continuing with the stone filling. Fill using courses of 1 foot (0.3 m) or less.

NOTE: During stone placement, do not fill any cell more than 1 foot (0.3 m) higher than the adjacent cell; also do not drop stone into the baskets from higher than 3 feet (1 m).

3.2 Along exposed faces, arrange the stone by hand to ensure a neat and compact appearance. Uniformly overfill gabions and revetment mattresses by approximately 1 1/ 2 inches (38 mm). Allow for the proper closing of the lid and provide an even, uniformly-appearing surface.

NOTE: Do not underfill.

(4) Connecting Wires. For gabion baskets greater than 2 feet (0.6 m) in height having exposed faces, place two uniformly-spaced internal connecting wires between each stone course connecting the back and the front faces of each cell. Loop connecting wires around two mesh openings or a single welded-wire joint on each basket face. Securely twist the wire terminals.

(5) Basket Lids. Stretch lids tightly over the stone fill using an approved lid-closing tool, until the lid meets the perimeter edges of the front and end panels. Do not use crowbars or other single-point leverage bars for lid closing. Close the lid with lacing wire or approved wire fasteners, along the edges, ends, and internal-cell diaphragms. Turn projections or wire ends into the baskets.

(6) Partial Baskets. For partial baskets, cut, fold, and wire together the basket to suit existing site conditions. Fold the mesh back and neatly wire to the adjacent basket face. Perform the assembly, installation, filling, lid closing, and lacing of the reshaped partial basket as specified above.

(7) PVC Coated Baskets. Do not install PVC coated materials until the ambient air temperature and the temperature of the PVC materials are at least 15°F (8°C) above the brittleness temperature of the PVC materials.

(g) **Backfilling.** Backfill behind gabions according to Subsection 202.02(b) of the Specifications.

(h) **Retaining Walls.** Construct retaining walls on a 6 to 10% batter (when indicated on the plans). Offset vertical joints in a layer from the previous layer.

602.05. METHOD OF MEASUREMENT.

Measure acceptable *gabions and revetment mattresses,* complete in place, by the cubic yard (cubic meter) as constructed to the dimensions shown on the plans or approved by the Engineer. Measure acceptable *filter fabric,* complete in place, by the square yard (square meter) as constructed to the dimensions shown on plans or approved by the Engineer.

Include stone fill and filter sand for gabions and revetment mattresses in the price bid for the respective bid item. Unless otherwise shown on the Plans, include backfill for gabions in the price bid for gabions.

602.06. BASIS OF PAYMENT.

Accepted quantities of gabions, revetment mattresses, filter fabric measured as provided above, will be paid for at the contract unit price as follows:

(A) GABIONS ..... CUBIC YARD (CUBIC METER)
(B) REVETMENT MATTRESSES ..... SQUARE YARD (SQUARE METER)
(C) FILTER FABRIC ..... SQUARE YARD (SQUARE METER)

Such payment shall be full compensation for furnishing all materials, equipment, labor, tools, and incidentals to complete the work as specified

.

SECTION 603
STEEL JETTY BANK PROTECTION

603.01. DESCRIPTION.

This work shall consist of furnishing materials and placing steel jetty bank protection; this consists of a main line jetty with or without back up jetties as shown on the Plans. The jetties shall consist of steel jacks connected by steel cable or reinforcing bars to a deadman at the anchoring end.

The length of main line and back up jetties and the distance between lines of jetties shall be substantially as shown on the Plans; however, if erosive conditions develop after preparation and approval of Plans, it may be desirable to increase or decrease the length or alter the position of the jetties.

603.02. MATERIALS.

(a) **Steel Jack**. Each jack shall consist of the following:

- Three new structural steel angles size 4x4 inch x 1/4 inch x 16 feet (100x100mm x 6mm x 4.8m)
- Six 1/2 inch (13mm) x 1 1/2 inch (38 mm) high strength bolts with hexagon heads and nuts